

BA/WTR
Arapaho
Mail Stop 60189

Memorandum

To: File
From: Refuge Hydrologist, Water Resources Division, Region 6
Subject: Rating of new outlet structures for MacFarlane Reservoir

Gene Patton, Refuge Manager, Kim Eickmann, engineer that designed the structure and myself worked on the new outlet structure. We put in staff gages for both Evan's and FWS ditches. Through manipulation of the main outlet of the reservoir and the new gates to these ditches we created a staff/discharge relationship. Flow measurements were taken at 5 different staff gage elevations to create the attached table and graphs. The rating curve represented below one foot ar my predictions, because the regression equation predicted negative numbers.

We also inspected the groundwater monitoring wells that were put in the dam. These wells looked very dry. The one highest on the dam did have a trickle noise inside it. At the outlet pipe for the dam there were two pipes to drain the toe of the dam, those pipes were flowing.

We also checked the elevation of the new structure. We tied it to the top of the main outlet structure. We also measured the invert of the dam, the deck of the new structure and the inverts of both canal pipes. Kim will include this data in the "as built" file.

Top of dam outlet structure	6.10'
Invert of dam outlet	11.30'
Floor of new structure	13.15'
FWS invert of canal	14.70'
Evan's invert of canal	13.75'

See attached

cc: Mike Stempel
Kim Eickmann
Gene Patten

Gene

RELEASES FROM MACFARLANE RESERVOIR

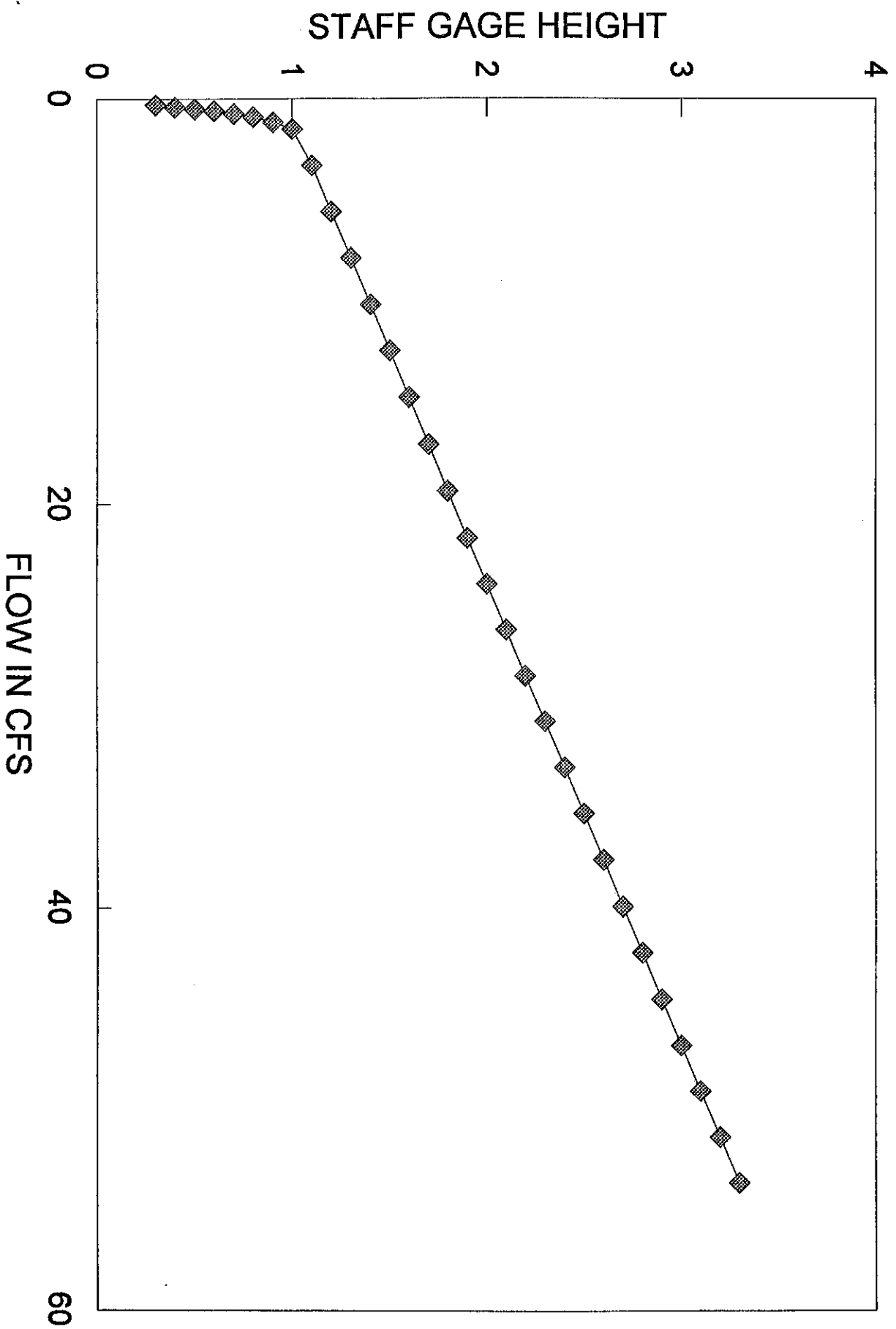
EVANS CANAL

gage height	flow cfs
0.3	0.3
0.4	0.4
0.5	0.5
0.6	0.6
0.7	0.8
0.8	0.9
0.9	1.2
1	1.5
1.1	3.3
1.2	5.6
1.3	7.9
1.4	10.2
1.5	12.5
1.6	14.7
1.7	17.0
1.8	19.3
1.9	21.6
2	23.9
2.1	26.2
2.2	28.5
2.3	30.7
2.4	33.0
2.5	35.3
2.6	37.6
2.7	39.9
2.8	42.2
2.9	44.4
3	46.7
3.1	49.0
3.2	51.3
3.3	53.6

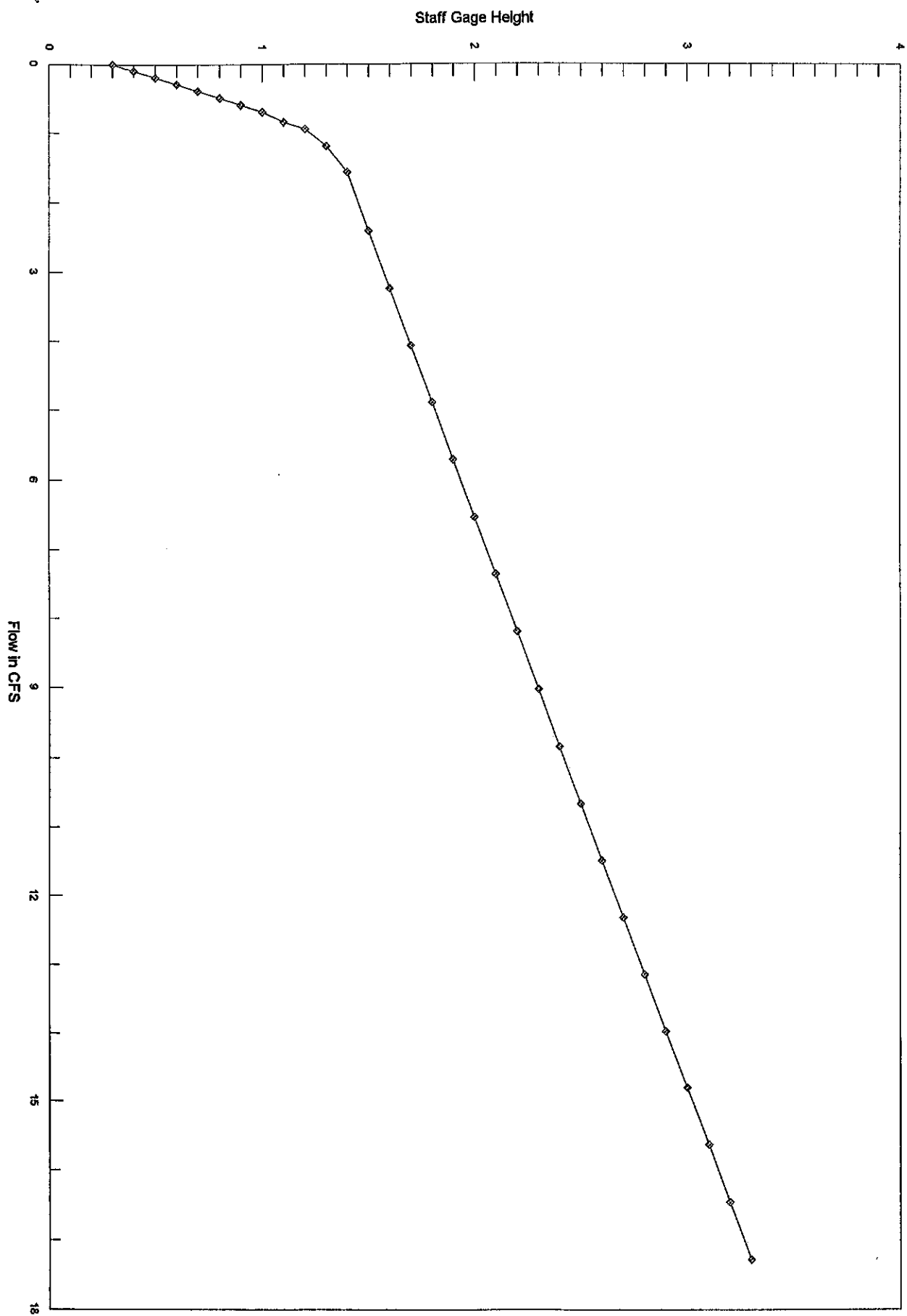
FWS CANAL

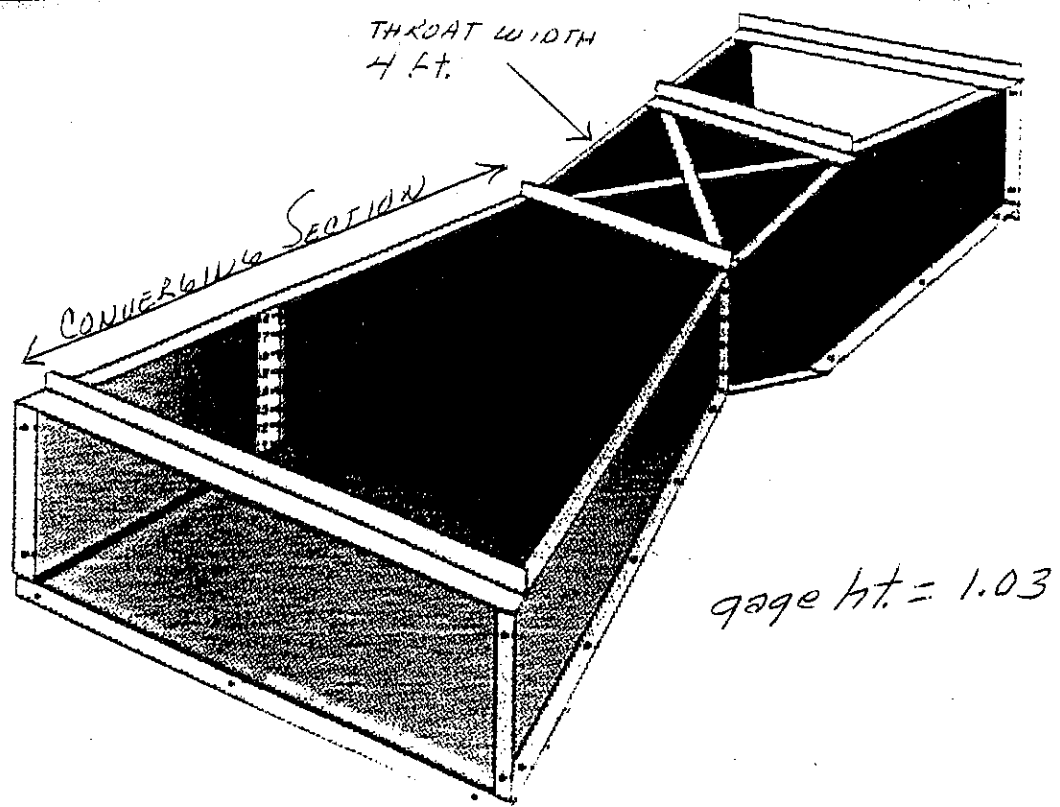
gage height	flow cfs
0.3	0.00
0.4	0.10
0.5	0.20
0.6	0.30
0.7	0.40
0.8	0.50
0.9	0.60
1	0.70
1.1	0.85
1.2	1.00
1.3	1.20
1.4	1.57
1.5	2.40
1.6	3.22
1.7	4.05
1.8	4.88
1.9	5.70
2	6.53
2.1	7.36
2.2	8.18
2.3	9.01
2.4	9.84
2.5	10.66
2.6	11.49
2.7	12.32
2.8	13.14
2.9	13.97
3	14.80
3.1	15.62
3.2	16.45
3.3	17.28

EVANS CANAL AT MACFARLANE RES.



FWS CANAL FROM MACFARLANE RES.





CHIP TEST EXAMPLE:

$$T_1 = 1.9 \text{ SECS}$$

$$T_2 = \cancel{1.8}$$

$$T_3 = 2.0$$

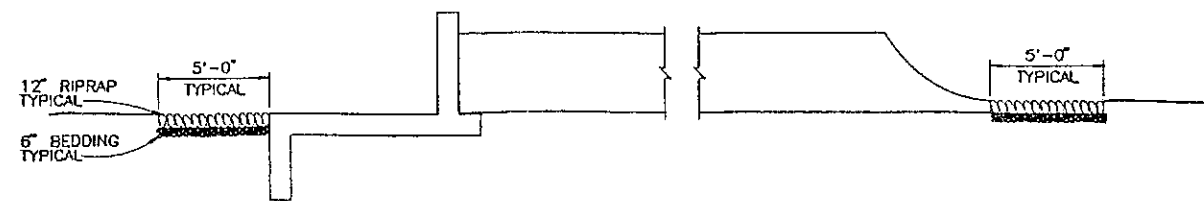
$$T_4 = 1.9$$

$$T_5 = \cancel{2.1}$$

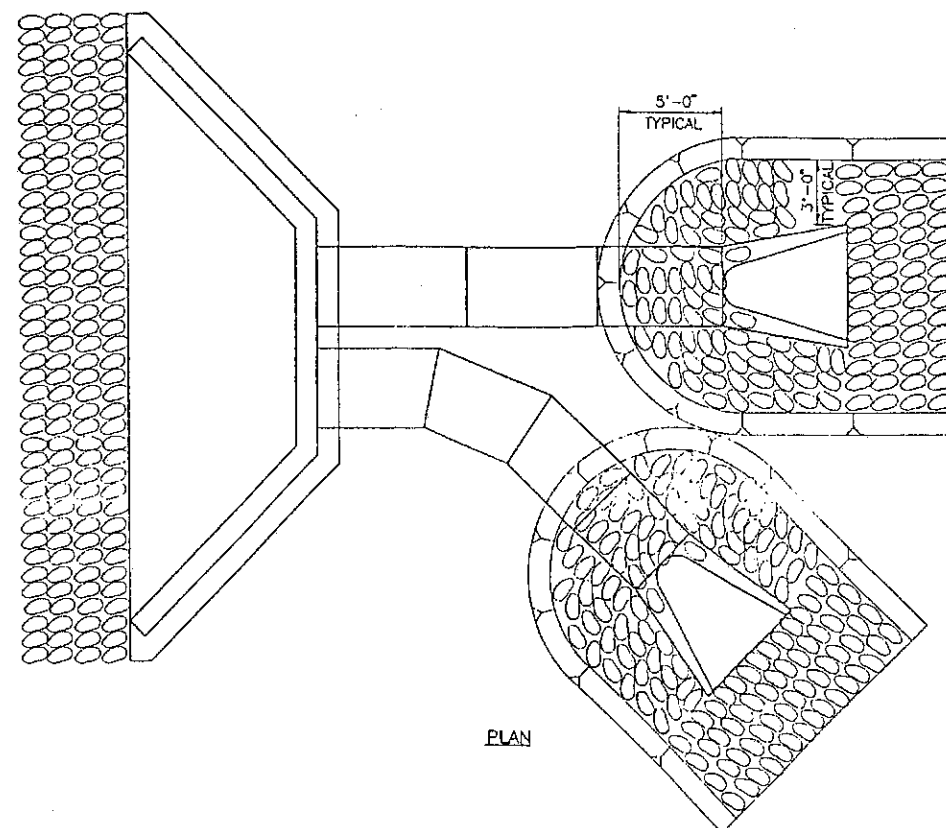
$$\text{AVERAGE } T = 1.93 \text{ SECS}$$

$$Q = \frac{(1.03)(26)}{1.93}$$

$$Q = 13.9 \text{ cfs}$$

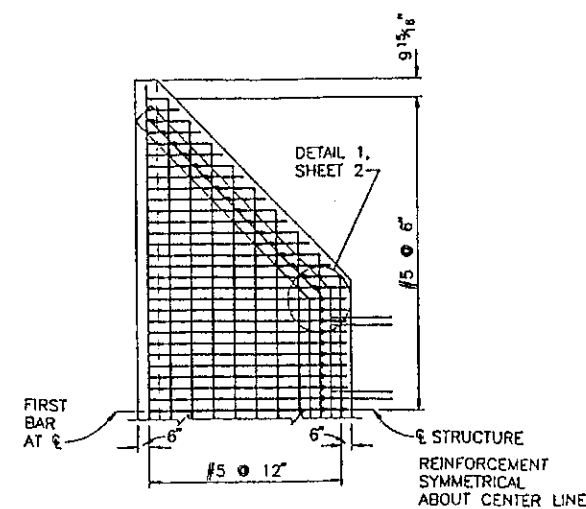


PROFILE

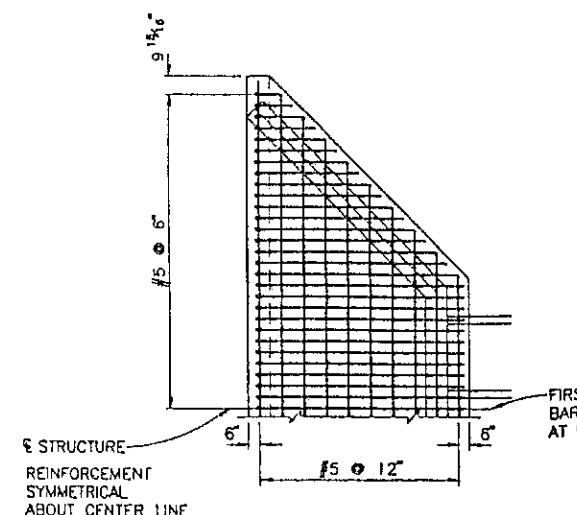


PLAN

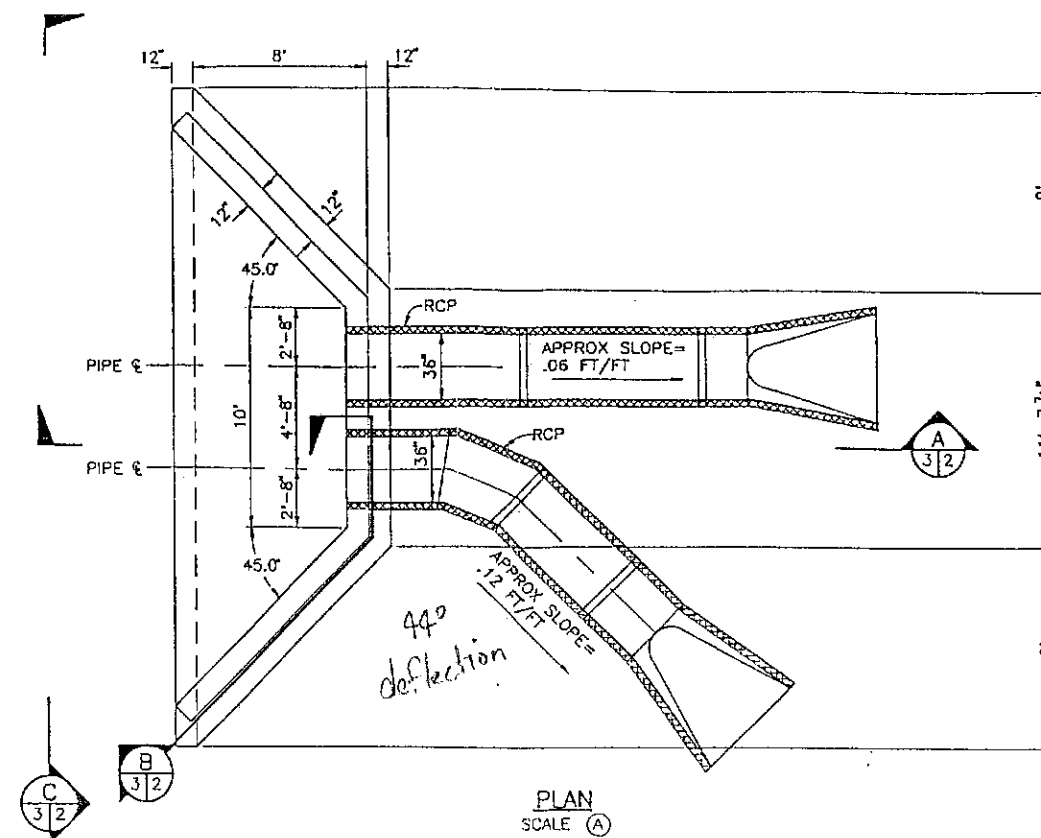
BEDDING/RIPRAP DETAILS
SCALE (A)



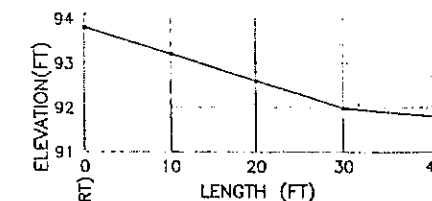
HALF PLAN-BOTTOM FACE REINFORCEMENT
SCALE (A)



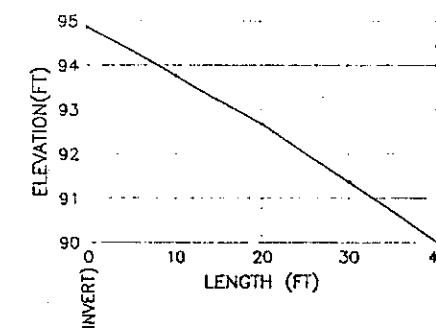
HALF PLAN-TOP FACE REINFORCEMENT
SCALE (A)



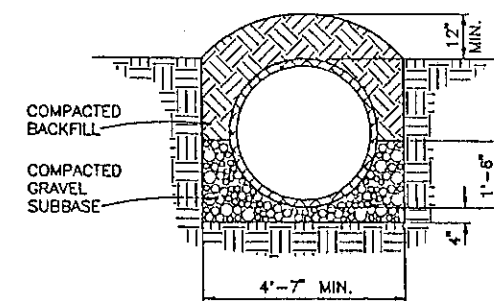
PLAN
SCALE (A)



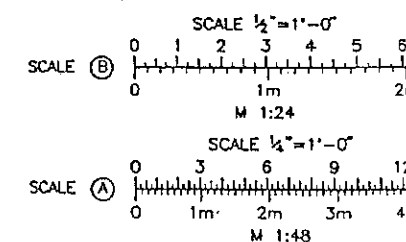
EXISTING MACFARLANE DITCH PROFILE
NO SCALE



EXISTING SOAP CREEK PROFILE
NO SCALE



BACKFILL AND PIPE BEDDING DETAIL
SCALE (B)

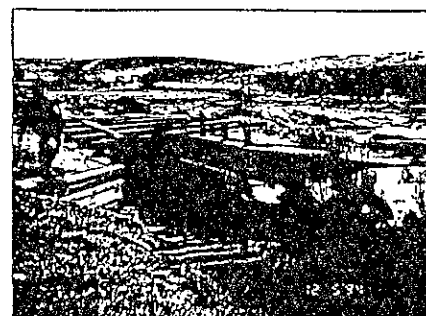


ARAPAHO NWR					SUB-SHEET	
MACFARLANE DIVERSION STRUCTURE					SHEET 3 OF 3	
DESIGNED K. FICKMATH	DRAWN D. MAHARI	CHECKED J. WHYTE	DATE 5-3-95	DRAWING NO. SR-CD-798-17.2		

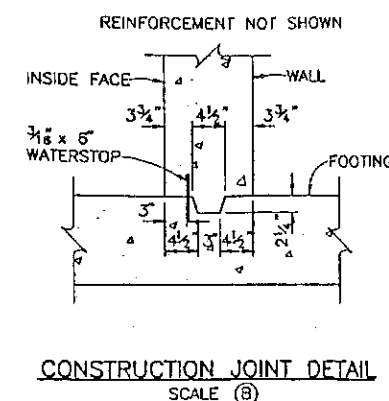
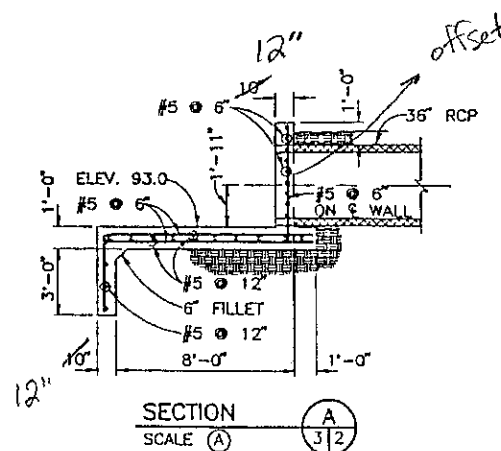
PLANS, PROFILES
AND DETAILS



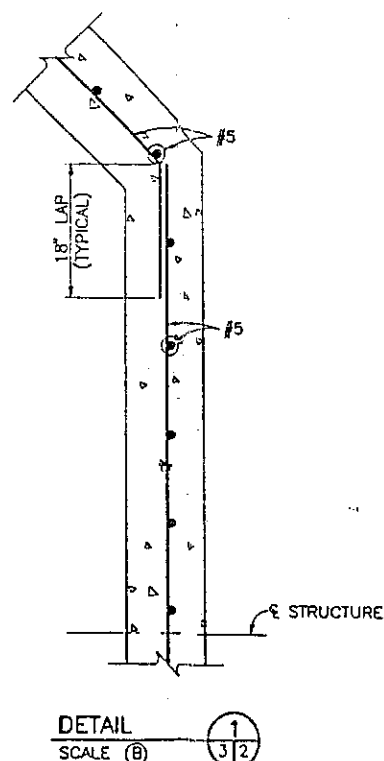
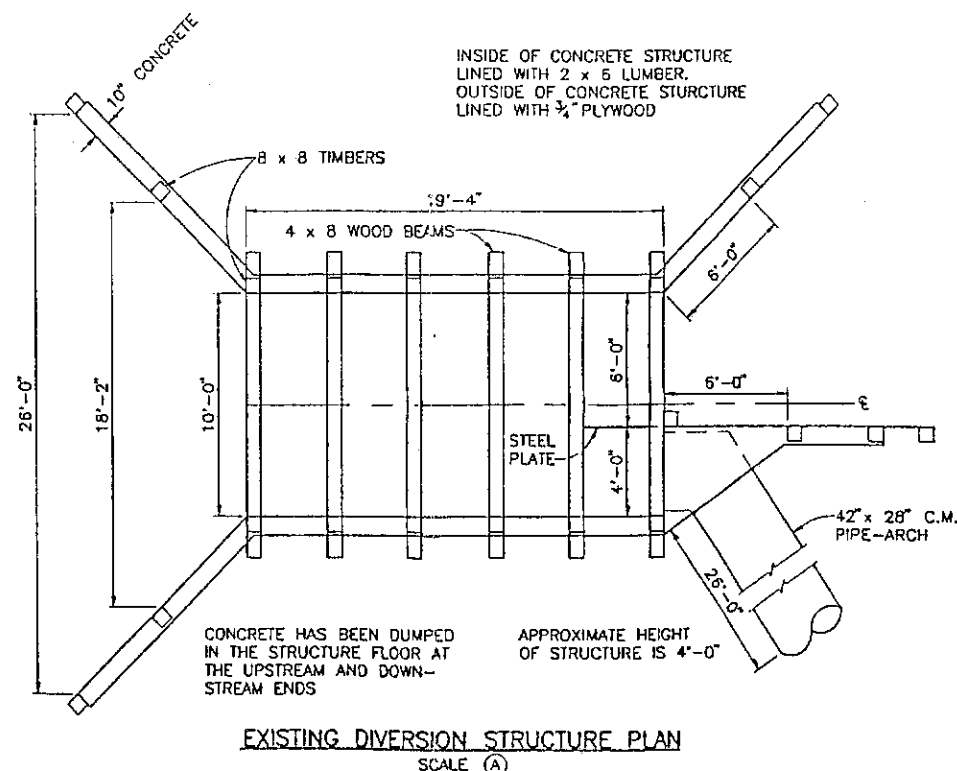
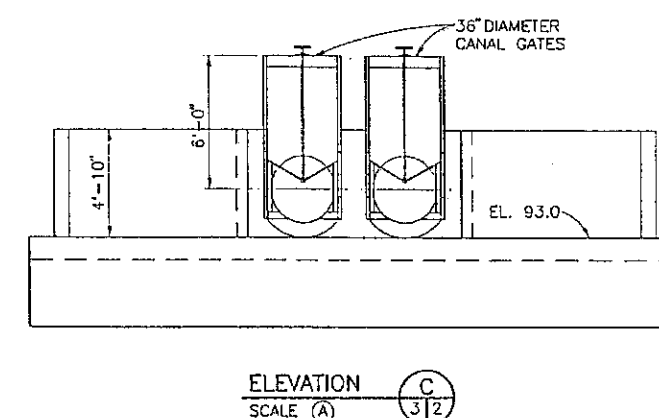
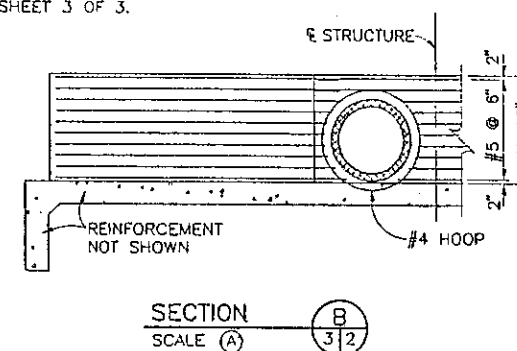
UPSTREAM OF EXISTING STRUCTURE



DOWNSTREAM OF EXISTING STRUCTURE

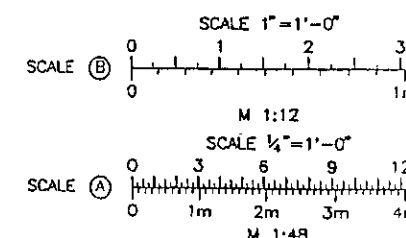


NOTE:
FOR VERTICAL REINFORCEMENT, SEE
SECTION A, THIS SHEET, AND HALF
PLAN BOTTOM FACE REINFORCEMENT,
SHEET 3 OF 3.



NOTES:

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND ELEVATIONS, AND FURNISH ALL PERMITS REQUIRED FOR THE WORK.
2. REMOVE EXISTING WOOD, METAL, AND CONCRETE DIVERSION STRUCTURE. CONCRETE SHALL BE BROKEN UP INTO RIPRAP SIZE PIECES AND STOCKPILED OR HAULED FROM THE SITE AT THE CONTRACTOR'S EXPENSE. WOOD SHALL BE STOCKPILED OR HAULED FROM THE SITE AT THE CONTRACTOR'S EXPENSE. ALL OTHER DEMOLISHED MATERIALS SHALL BE HAULED FROM THE SITE AT THE CONTRACTOR'S EXPENSE. REFER TO SPECIFICATION SECTION 02060.
3. CONSTRUCT NEW DIVERSION STRUCTURE IN SIMILAR LOCATION AS EXISTING STRUCTURE, SUCH THAT THE REINFORCED CONCRETE PIPES (RCP) ARE ALIGNED WITH THE EXISTING DITCHES AS SHOWN ON SHEET 1.
4. CONTRACTOR SHALL USE 3 STANDARD LENGTHS OF PIPE TO MAKE APPROXIMATELY 24 FEET OF PIPELINE IN EACH DITCH.
5. BEDDING AND RIPRAP SHALL BE PLACED AS SHOWN.
6. INSTALL 2 NEW 36" DIAMETER CANAL GATES AS SHOWN.
7. FORM A WATER-TIGHT SEAL BETWEEN THE HEAD WALL AND THE RCP.



ARAPAHO NWR				PLAN, SECTIONS, ELEVATION		SUB-SHEET
MACFARLANE DIVERSION STRUCTURE				PHOTOS AND DETAILS		
DESIGNED K. EICKMANN	DRAWN D. MAHAN	CHECKED J. MIYAKE	DATE 6-14-95	DRAWING NO. 62-CO-183-32.0	SHEET 2 OF 3	